

## SEQUENCE LISTING

&lt;110&gt; Universiteit Utrecht Holding B.V.

&lt;120&gt; Piroplasmid vaccine

&lt;130&gt; 2003-010

&lt;160&gt; 20

&lt;170&gt; PatentIn version 3.2

&lt;210&gt; 1

&lt;211&gt; 1818

&lt;212&gt; DNA

&lt;213&gt; Babesia bovis

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(1818)

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Cys Thr Thr Thr Ala Ile Val Leu Thr Ile Trp Ile Trp Lys Arg Phe	
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 Lys Glu Pro Asn Asn Arg Arg Leu Thr Lys Arg Ser Ser Arg Gly Gln  
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 Leu Leu Asn Ser Arg Arg Gly Ser Asp Asp Ala Ser Glu Ser Ser Asp  
 65 70 75 80  
 Arg Tyr Pro Gly Arg Ser Gly Gly Ser Lys Asn Ser Ser Gln Ser Pro  
 85 90 95  
 Trp Ile Lys Tyr Met Gln Lys Phe Asp Ile Pro Arg Asn His Gly Ser  
 100 105 110  
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 Tyr Arg Met Pro Val Gly Lys Cys Pro Val Val Gly Lys Ile Ile Asp  
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 145 150 155 160  
 Ser Tyr Arg Gly Leu Ala Phe Pro Glu Thr Ala Val Asp Ser Asn Ile  
 165 170 175  
 Pro Thr Gln Pro Lys Thr Arg Gly Ser Ser Ser Ala Ser Ala Ala Lys  
 180 185 190  
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 195 200 205  
 Asn Asp Val Ala Asn Cys Ser Glu Tyr Ala Ser Asn Leu Ile Pro Ala  
 210 215 220  
 Ser Asp Arg Ser Thr Lys Tyr Arg Tyr Pro Phe Val Phe Asp Ser Asp  
 225 230 235 240

Asn Gln Met Cys Tyr Ile Leu Tyr Ser Ala Ile Gln Tyr Asn Gln Gly  
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275 280 285

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355 360 365

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370 375 380

Ser Asn Val Ala Gly Thr Ser Arg Ile Ser Arg Gly Val Gly Met Asn  
385 390 395 400

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Thr Pro Asn Cys Leu Ile Leu Asn Ala Gly Ser Ile Ala Leu Thr Ala  
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Ile Gly Ser Pro Leu Glu Tyr Asp Ala Val Asn Tyr Pro Cys His Ile  
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Asp Thr Asn Gly Tyr Val Glu Pro Arg Ala Lys Asn Thr Asn Lys Tyr  
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cct	gtg	tta	gga	agc	aac	tct	gac	cct	tcg	gaa	gag	tat	gat	tca	ttc	96
Pro	Val	Leu	Gly	Ser	Asn	Ser	Asp	Pro	Ser	Glu	Glu	Tyr	Asp	Ser	Phe	
			20					25					30			
cag	caa	aat	gtt	ttc	act	cat	caa	cca	acc	caa	cta	cac	aaa	tct	cat	144
Gln	Gln	Asn	Val	Phe	Thr	His	Gln	Pro	Thr	Gln	Leu	His	Lys	Ser	His	
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His	Tyr	Ile	Thr	His	Gln	Lys	Lys	Thr	Ser	Gln	His	Ile	Asp	Asp	Leu	
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Lys Val Val Asn Asn Ser Arg Asn Leu Val Glu Gly Glu Thr Leu Ser	85	90	95	
aag gat gac aat aaa aca aaa tct aaa ata aag tca aaa aca gca tca				336
Lys Asp Asp Asn Lys Thr Lys Ser Lys Ile Lys Ser Lys Thr Ala Ser	100	105	110	
att tta cct aga ctt tta aaa tct tta tca ttt tta gct gtt tta ggg				384
Ile Leu Pro Arg Leu Leu Lys Ser Leu Ser Phe Leu Ala Val Leu Gly	115	120	125	
tca att aat tca ttt tca tta gca tta gag gaa cct ttt act caa cac				432
Ser Ile Asn Ser Phe Ser Leu Ala Leu Glu Glu Pro Phe Thr Gln His	130	135	140	
act tct aac cga acg ccc ttt gaa gta tca tta att caa agc aac agc				480
Thr Ser Asn Arg Thr Pro Phe Glu Val Ser Leu Ile Gln Ser Asn Ser	145	150	155	160
agt tta tcg cct att cat aat tct tca act caa aat tca agt cat cac				528
Ser Leu Ser Pro Ile His Asn Ser Ser Thr Gln Asn Ser Ser His His	165	170	175	
aac ggt ttt agt ggt agt acc gtt aat aat acc tca tta ata gag aca				576
Asn Gly Phe Ser Gly Ser Thr Val Asn Asn Thr Ser Leu Ile Glu Thr	180	185	190	
agg aat aac gta tta aac aga aca cta ggt aga ttc gga tca ttt ttg				624
Arg Asn Asn Val Leu Asn Arg Thr Leu Gly Arg Phe Gly Ser Phe Leu	195	200	205	
caa tca gga ttg ata agc agt aga gca gac aaa aag aag cgg tct ggt				672
Gln Ser Gly Leu Ile Ser Ser Arg Ala Asp Lys Lys Lys Arg Ser Gly	210	215	220	
atg aat aga aga ggc cct aag ggg aag aaa ggg aag gga gga gaa gac				720
Met Asn Arg Arg Gly Pro Lys Gly Lys Lys Gly Lys Gly Gly Glu Asp	225	230	235	240
gaa gaa aag agg aac aag tgg acc gat ttc atg gca aag ttt gat atc				768
Glu Glu Lys Arg Asn Lys Trp Thr Asp Phe Met Ala Lys Phe Asp Ile	245	250	255	
gct aag gtc cac ggt tca ggg gtt tac gta gat ttg ggt gaa tct gcc				816
Ala Lys Val His Gly Ser Gly Val Tyr Val Asp Leu Gly Glu Ser Ala	260	265	270	
acc gtt ggc agt tat gac tac agg atg cct ata gga aaa tgt cca gtt				864
Thr Val Gly Ser Tyr Asp Tyr Arg Met Pro Ile Gly Lys Cys Pro Val	275	280	285	
gta ggt aag gca atc ata ctc gag aat gga gct gat ttt ttg agc agc				912
Val Gly Lys Ala Ile Ile Leu Glu Asn Gly Ala Asp Phe Leu Ser Ser	290	295	300	
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325 330 335	
tca cca att agt gct cag gtc cta agg agc tgg aat tat aaa cac gaa	1056
Ser Pro Ile Ser Ala Gln Val Leu Arg Ser Trp Asn Tyr Lys His Glu	
340 345 350	
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Ser Asp Leu Ser Asn Cys Ala Glu Tyr Ser Arg Asn Ile Val Pro Gly	
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Glu Lys Leu Cys Tyr Ile Leu Tyr Ser Pro Met Gln Tyr Asn Gln Gly	
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Val Lys Tyr Cys Asp Gln Asp Ser Pro Asp Glu Gly Thr Ser Ser Leu	
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Ala Cys Met Tyr Pro Asp Lys Ser Lys Glu Asp Ser His Leu Phe Tyr	
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Trp Ala Thr Tyr Ser Val Glu Glu Lys Lys Cys Asn Ile Leu Asp Val	
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Ala Gln Glu Pro Pro Lys Glu Pro Glu Pro Glu Glu Pro Lys Lys Glu
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Gly Ala Glu Asn Lys Pro Lys Glu Lys Gly Lys Ser Glu Lys Lys Asn
                    625                      630                      635                      640

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Glu Lys Ser Met Pro Ser Gly Pro Phe Thr Pro Tyr Thr Ser Leu Lys
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Asn Tyr Tyr Asn Glu Asp Phe Asp Asp Glu Gln Asp Arg Asp Glu Tyr
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gct tcg aat gtt aga ggt gat caa atc tgg agc aga cac act cca gac      2304
Ala Ser Asn Val Arg Gly Asp Gln Ile Trp Ser Arg His Thr Pro Asp
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Lys Val Val Asn Asn Ser Arg Asn Leu Val Glu Gly Glu Thr Leu Ser  
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11/29

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Thr Val Gly Ser Tyr Asp Tyr Arg Met Pro Ile Gly Lys Cys Pro Val						
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Val Gly Lys Ala Ile Ile Leu Glu Asn Gly Ala Asp Phe Leu Ser Ser						
		290		295		300
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Ala Cys Met Tyr Pro Asp Lys Ser Lys Glu Asp Ser His Leu Phe Tyr						
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Pro Ile Arg Asp Ser Ile Phe Gly Ser Tyr Asp Asp Gln Lys Asp Glu						
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Cys Val Pro Ile Glu Pro Ile Phe Glu Glu Glu Ala Glu Asp Tyr Glu						
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						480

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 565 570 575  
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 Ala Gln Glu Pro Pro Lys Glu Pro Glu Pro Glu Glu Pro Lys Lys Glu  
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 Gly Ala Glu Asn Lys Pro Lys Glu Lys Gly Lys Ser Glu Lys Lys Asn  
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 Glu Lys Ser Met Pro Ser Gly Pro Phe Thr Pro Tyr Thr Ser Leu Lys  
 645 650 655  
 Lys Glu Gly Phe Glu Cys Ser Lys Tyr Thr Val Glu Arg Val Asn Lys  
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 Ser Cys Gly Val Tyr Tyr Glu Cys Ser Glu Thr Pro Val Leu Phe Thr  
 675 680 685  
 Lys Lys Asn Arg Ile Tyr Leu Tyr Ile Ile Leu Ala Val Ser Leu Val  
 690 695 700  
 Val Leu Ala Val Leu Ala Tyr Phe Gly Tyr Arg Tyr Tyr Ser Lys Asn  
 705 710 715 720

His Leu Lys Lys His Asn Ser Gln Ile Tyr Glu Asp Asp Asn Val Asn  
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Asn Tyr Tyr Asn Glu Asp Phe Asp Asp Glu Gln Asp Arg Asp Glu Tyr  
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gcc ttt tta gct aca acg ggg ata cat gct ttt gcg gac aaa ggt att 96  
Ala Phe Leu Ala Thr Thr Gly Ile His Ala Phe Ala Asp Lys Gly Ile  
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ggt tca cca aag ggg aaa caa tgc aag aag caa ctt gac ttt tcg att 144  
Gly Ser Pro Lys Gly Lys Gln Cys Lys Lys Gln Leu Asp Phe Ser Ile  
35 40 45  
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Val Val Asp Glu Ser Ala Ser Ile Ser Asp Asp Gln Trp Glu Gly Gln  
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Met Ile Pro Phe Leu Arg Asn Leu Ile His Thr Val Asp Leu Asp Asn  
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act gac ata cgt ctt tcg ctt acc act tac tca act cca act cgc cag 288  
Thr Asp Ile Arg Leu Ser Leu Thr Thr Tyr Ser Thr Pro Thr Arg Gln  
85 90 95  
ata ttt acg ttt ttg gat gct gct gca agc agt acc agg ctc gca ctc 336  
Ile Phe Thr Phe Leu Asp Ala Ala Ser Ser Thr Arg Leu Ala Leu  
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Thr Lys Leu Asp Trp Met Asn Gly Thr Lys Ala Arg Tyr Gly Met Thr  
115 120 125

tac act ggc agg gct ctg aac tac gtt cgt aag gct ata cta cca tat	432
Tyr Thr Gly Arg Ala Leu Asn Tyr Val Arg Lys Ala Ile Leu Pro Tyr	
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Gly Arg Lys Asn Val Pro Lys Ala Leu Leu Ile Thr Asp Gly Val	
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Ser Ser Asp Gly Ser Tyr Thr Ala Gln Val Ala Ala Met Leu Arg Asp	
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Glu Gly Val Asn Val Met Val Ile Gly Val Gly Asp Val Asn Val Ala	
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Glu Cys Arg Gly Ile Val Gly Cys Asp Gly Ile Met Asp Cys Pro Met	
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Phe Lys Gln Thr Asn Trp Lys Asp Ile Met Gly Leu Phe Asn Ser Leu	
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245 250 255	
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Lys Arg Thr Arg Ala Leu Leu Asp Leu Arg Met Ile Glu Lys Pro Val	
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Asn Gly Ser Asn Gly Gln Pro Gly Lys Ser Cys Glu Asp Gln Lys Met	
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Asn Phe Leu Pro Gln Ser Glu Thr Cys Thr Ile Glu Cys Asn His Glu	
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cct gtg cca agc tcg ccg gaa cct gta tca gat gat atg gat cac cca	960
Pro Val Pro Ser Ser Pro Glu Pro Val Ser Asp Asp Met Asp His Pro	
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Glu Pro Thr Pro Val Thr Pro Glu Gly Asp Met Asp Lys Ser His Ser	
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cat tcg agc att cca tcc acc cct gat atg cca tca agt cac agt gat	1056
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Met Ser Ser Ser Pro Thr Asp Met Ser Ser Ser Pro Thr Asp Met Ser	
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Ser 370	Ser	Pro	Thr	Asp	Met	Ser 375	Ser	Ser	His	Ser	Asp 380	Met	Pro	Ser	Thr	
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Pro	Thr	Gly	Met	Ser	Ser	Ser	His	Ser	Asp	Met	Pro	Ser	Ser	His	Ser	
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Asp	Met	Pro	Ser	Ser	His	Ser	Asp	Met	Ser	Ser	Ser	Pro	Thr	Asp	Met	1248
tca 420	tca	agt	cac	gct	gat	act	cgt	gta	gga	aat	acc	gat	gaa	gaa	cat	
Ser	Ser	Ser	His	Ala	Asp	Thr	Arg	Val	Gly	Asn	Thr	Asp	Glu	Glu	His	1296
aac 435	cac	agg	aaa	gat	atg	gat	gtc	aag	ttc	ccc	gaa	aat	atg	gat	gat	
Asn	His	Arg	Lys	Asp	Met	Asp	Val	Lys	Phe	Pro	Glu	Asn	Met	Asp	Asp	1344
atc 450	cca	gtc	gag	gat	aat	cct	ata	ccc	aca	gat	cct	aga	cat	ggc	gtc	
Ile	Pro	Val	Glu	Asp	Asn	Pro	Ile	Pro	Thr	Asp	Pro	Arg	His	Gly	Val	1392
gaa 465	cca	tcg	cct	tct	gat	gtg	atc	cct	gag	gat	gac	caa	ctt	cgt	agg	
Glu	Pro	Ser	Pro	Ser	Asp	Val	Ile	Pro	Glu	Asp	Asp	Gln	Leu	Arg	Arg	1440
acg 485	ctt	gaa	atg	cag	cgc	gaa	gag	gac	cta	aag	aag	gaa	ttg	atg	ctc	
Thr	Leu	Glu	Met	Gln	Arg	Glu	Glu	Asp	Leu	Lys	Lys	Glu	Leu	Met	Leu	1488
caa 500	cat	gaa	ctg	aag	ctt	cag	gaa	gaa	aag	gaa	agg	gca	gct	att	tta	
Gln	His	Glu	Leu	Lys	Leu	Gln	Glu	Glu	Lys	Glu	Arg	Ala	Ala	Ile	Leu	1536
gag 515	aat	aac	act	cct	tat	gga	tcc	gcc	act	tcc	gtg	tcg	caa	gac	ggg	
Glu	Asn	Asn	Thr	Pro	Tyr	Gly	Ser	Ala	Thr	Ser	Val	Ser	Gln	Asp	Gly	1584
gaa 530	tct	cca	act	ggc	gta	ccc	caa	agt	agc	gag	acc	gat	gca	ata	cgt	
Glu	Ser	Pro	Thr	Gly	Val	Pro	Gln	Ser	Ser	Glu	Thr	Asp	Ala	Ile	Arg	1632
cac 545	gag	gtg	tat	gac	gat	cac	ccc	gag	gaa	tct	gaa	aac	acc	ggg	att	
His	Glu	Val	Tyr	Asp	Asp	His	Pro	Glu	Glu	Ser	Glu	Asn	Thr	Gly	Ile	1680
aat 565	gct	gat	gtg	acc	gaa	tct	gag	gac	tat	gag	ggg	gaa	aaa	caa	aag	
Asn	Ala	Asp	Val	Thr	Glu	Ser	Glu	Asp	Tyr	Glu	Gly	Glu	Lys	Gln	Lys	1728
gac 580	gaa	tca	aat	gaa	cgt	tcg	acc	agc	aat	act	act	aag	att	gcc	ggc	
Asp	Glu	Ser	Asn	Glu	Arg	Ser	Thr	Ser	Asn	Thr	Thr	Lys	Ile	Ala	Gly	1776
ggg 595	gct	cta	cta	ggg	ctt	ctt	ctc	ctt	ggg	gcc	ggg	ggg	gga	tac	gct	
Gly	Ala	Leu	Leu	Gly	Leu	Leu	Leu	Leu	Gly	Ala	Gly	Gly	Gly	Tyr	Ala	1824
atg 600	tac	aaa	aag	aac	aag	aca	cct	act	gtt	gag	aca	ggg	tca	ggg	gat	
Met	Tyr	Lys	Lys	Asn	Lys	Thr	Pro	Thr	Val	Glu	Thr	Gly	Ser	Gly	Asp	1872

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Tyr Thr Gly Ala Asp Glu Ser Ser Glu Pro Met Lys Glu Gly Asp Thr
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<213> Babesia bovis

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Gly Ser Pro Lys Gly Lys Gln Cys Lys Lys Gln Leu Asp Phe Ser Ile
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Val Val Asp Glu Ser Ala Ser Ile Ser Asp Asp Gln Trp Glu Gly Gln
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Met Ile Pro Phe Leu Arg Asn Leu Ile His Thr Val Asp Leu Asp Asn
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Thr Asp Ile Arg Leu Ser Leu Thr Thr Tyr Ser Thr Pro Thr Arg Gln
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Ile Phe Thr Phe Leu Asp Ala Ala Ala Ser Ser Thr Arg Leu Ala Leu
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Thr Lys Leu Asp Trp Met Asn Gly Thr Lys Ala Arg Tyr Gly Met Thr
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Tyr Thr Gly Arg Ala Leu Asn Tyr Val Arg Lys Ala Ile Leu Pro Tyr
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Gly Arg Lys Asn Val Pro Lys Ala Leu Leu Leu Ile Thr Asp Gly Val
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Ser Ser Asp Gly Ser Tyr Thr Ala Gln Val Ala Ala Met Leu Arg Asp
        165                170                175

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Glu Gly Val Asn Val Met Val Ile Gly Val Gly Asp Val Asn Val Ala  
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Glu Cys Arg Gly Ile Val Gly Cys Asp Gly Ile Met Asp Cys Pro Met  
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Phe Lys Gln Thr Asn Trp Lys Asp Ile Met Gly Leu Phe Asn Ser Leu  
 210 215 220

Met Lys Glu Val Cys Asp Ile Leu Pro Gln Asp Ala Val Cys Glu Pro  
 225 230 235 240

Val Trp Ala Glu Trp Ser Ser Cys Asn Gly Glu Cys Gly Val Pro Gly  
 245 250 255

Lys Arg Thr Arg Ala Leu Leu Asp Leu Arg Met Ile Glu Lys Pro Val  
 260 265 270

Asn Gly Ser Asn Gly Gln Pro Gly Lys Ser Cys Glu Asp Gln Lys Met  
 275 280 285

Asn Phe Leu Pro Gln Ser Glu Thr Cys Thr Ile Glu Cys Asn His Glu  
 290 295 300

Pro Val Pro Ser Ser Pro Glu Pro Val Ser Asp Asp Met Asp His Pro  
 305 310 315 320

Glu Pro Thr Pro Val Thr Pro Glu Gly Asp Met Asp Lys Ser His Ser  
 325 330 335

His Ser Ser Ile Pro Ser Thr Pro Asp Met Pro Ser Ser His Ser Asp  
 340 345 350

Met Ser Ser Ser Pro Thr Asp Met Ser Ser Ser Pro Thr Asp Met Ser  
 355 360 365

Ser Ser Pro Thr Asp Met Ser Ser Ser His Ser Asp Met Pro Ser Thr  
 370 375 380

Pro Thr Gly Met Ser Ser Ser His Ser Asp Met Pro Ser Ser His Ser  
 385 390 395 400

Asp Met Pro Ser Ser His Ser Asp Met Ser Ser Ser Pro Thr Asp Met  
 405 410 415

Ser Ser Ser His Ala Asp Thr Arg Val Gly Asn Thr Asp Glu Glu His  
 420 425 430

Asn His Arg Lys Asp Met Asp Val Lys Phe Pro Glu Asn Met Asp Asp  
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Ile Pro Val Glu Asp Asn Pro Ile Pro Thr Asp Pro Arg His Gly Val  
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Glu Pro Ser Pro Ser Asp Val Ile Pro Glu Asp Asp Gln Leu Arg Arg  
 465 470 475 480

Thr Leu Glu Met Gln Arg Glu Glu Asp Leu Lys Lys Glu Leu Met Leu  
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Gln His Glu Leu Lys Leu Gln Glu Glu Lys Glu Arg Ala Ala Ile Leu  
 500 505 510

Glu Asn Asn Thr Pro Tyr Gly Ser Ala Thr Ser Val Ser Gln Asp Gly  
 515 520 525

Glu Ser Pro Thr Gly Val Pro Gln Ser Ser Glu Thr Asp Ala Ile Arg  
 530 535 540

His Glu Val Tyr Asp Asp His Pro Glu Glu Ser Glu Asn Thr Gly Ile  
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Asn Ala Asp Val Thr Glu Ser Glu Asp Tyr Glu Gly Glu Lys Gln Lys  
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Asp Glu Ser Asn Glu Arg Ser Thr Ser Asn Thr Thr Lys Ile Ala Gly  
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Gly Ala Leu Leu Gly Leu Leu Leu Leu Gly Ala Gly Gly Gly Tyr Ala  
 595 600 605

Met Tyr Lys Lys Asn Lys Thr Pro Thr Val Glu Thr Gly Ser Gly Asp  
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 His Arg Glu Leu Asp Leu Thr Ile Leu Val Asp Glu Ser Ser Ser Ile  
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 Tyr Ile Glu Glu Trp Asn Lys Leu Ile Pro Phe Leu Lys Ser Leu Val  
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 aag gat gag caa ttg gcc ctt gct gtt ctg gac aag ctg aag aac agt 288  
 Lys Asp Glu Gln Leu Ala Leu Ala Val Leu Asp Lys Leu Lys Asn Ser  
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 Lys Pro Val Phe Gly Tyr Thr Phe Thr Gly Gln Ala Leu Asn Phe Ile  
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 Ser Glu Ala Val Tyr Met Phe Gly Ala Arg Arg Asn Ser Pro Lys Gly  
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 Ile Ile Ile Ile Thr Asp Gly Ser Ser Thr Gln Thr Asn Val Thr Ser  
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 Gly Val Gly Lys Ala Lys Glu Ser Glu Cys Arg Gly Ile Val Gly Cys  
 165 170 175  
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 Ser Thr Lys Gly Glu Cys Pro Leu Phe Phe Met Thr Asn Trp Asp Glu  
 180 185 190  
 att atc agg aag gtt ggg gag ttg atg gct gag gtt tgt gag acc att 624  
 Ile Ile Arg Lys Val Gly Glu Leu Met Ala Glu Val Cys Glu Thr Ile

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Pro Lys Asp Ala Val Cys	Lys Pro Ile Trp Ser	Asp Trp Ser Lys Cys	
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gac gcc aag tgc ggc att	ggg acg agg tac caa aag	ttg atg gga gtt	720
Asp Ala Lys Cys Gly Ile	Gly Thr Arg Tyr Gln Lys	Leu Met Gly Val	
225	230	235	240
act aca att tct gag cca	act gtc gga acg aac	ggc aag tcc ggg agg	768
Thr Thr Ile Ser	Glu Pro Thr Val Gly	Thr Asn Gly Lys Ser	
245	250	255	
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Thr Cys Glu Met Ile Tyr	Glu Asn Val Glu Val	Pro Lys Glu Glu Cys	
260	265	270	
tcc gtt gag tct aag att	gct gga gga gtg gct	cta gca ctg tta atg	864
Ser Val Glu Ser Lys Ile	Ala Gly Gly Val Ala	Leu Ala Leu Leu Met	
275	280	285	
ctt gca ggc gga ggt ggt	tac aca tac tac aaa	aag tac ggt tta tct	912
Leu Ala Gly Gly Gly Gly	Tyr Thr Tyr Tyr Lys	Lys Tyr Gly Leu Ser	
290	295	300	
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Arg Val Ser Glu Thr Thr	Asn Leu Asp Glu Asp	Phe Ala Asp Ser Ser	
305	310	315	320
ggg aac cgt ggt gta agg	gag agt gtg ggt gaa	gct tac aca gta act	1008
Gly Asn Arg Gly Val Arg	Glu Ser Val Gly Glu	Ala Tyr Thr Val Thr	
325	330	335	
gat tta gat gat gga ctc	tgg agc caa tcc aat	caa taa	1047
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&lt;211&gt; 348

&lt;212&gt; PRT

&lt;213&gt; Theileria annulata

&lt;400&gt; 8

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35 40 45

Arg Ser Ile Asn Ile Ser Pro Asn Tyr Val His Leu Ser Met Val Thr  
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Phe Ser Thr Ser Ile Arg Trp Leu Ile Ser Phe Leu Asp Pro Ala Ser  
65 70 75 80

Lys Asp Glu Gln Leu Ala Leu Ala Val Leu Asp Lys Leu Lys Asn Ser  
85 90 95

Lys Pro Val Phe Gly Tyr Thr Phe Thr Gly Gln Ala Leu Asn Phe Ile  
100 105 110

Ser Glu Ala Val Tyr Met Phe Gly Ala Arg Arg Asn Ser Pro Lys Gly  
115 120 125

Ile Ile Ile Ile Thr Asp Gly Ser Ser Thr Gln Thr Asn Val Thr Ser  
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Gln Ala Ser Ala Leu Leu Arg Asp Ala Gly Val Thr Ile Leu Val Val  
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Gly Val Gly Lys Ala Lys Glu Ser Glu Cys Arg Gly Ile Val Gly Cys  
165 170 175

Ser Thr Lys Gly Glu Cys Pro Leu Phe Phe Met Thr Asn Trp Asp Glu  
180 185 190

Ile Ile Arg Lys Val Gly Glu Leu Met Ala Glu Val Cys Glu Thr Ile  
195 200 205

Pro Lys Asp Ala Val Cys Lys Pro Ile Trp Ser Asp Trp Ser Lys Cys  
210 215 220

Asp Ala Lys Cys Gly Ile Gly Thr Arg Tyr Gln Lys Leu Met Gly Val  
225 230 235 240

Thr Thr Ile Ser Glu Pro Thr Val Gly Thr Asn Gly Lys Ser Gly Arg  
245 250 255

Thr Cys Glu Met Ile Tyr Glu Asn Val Glu Val Pro Lys Glu Glu Cys  
260 265 270

Ser Val Glu Ser Lys Ile Ala Gly Gly Val Ala Leu Ala Leu Leu Met  
275 280 285

Leu Ala Gly Gly Gly Gly Tyr Thr Tyr Tyr Lys Lys Tyr Gly Leu Ser  
290 295 300

22/29

Arg Val Ser Glu Thr Thr Asn Leu Asp Glu Asp Phe Ala Asp Ser Ser  
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Gly Asn Arg Gly Val Arg Glu Ser Val Gly Glu Ala Tyr Thr Val Thr  
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Ala Ile Ala Ser Ser Asn Thr Ile Phe Ala Thr Phe Arg Ser Asn Gly  
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Lys Thr Phe Gly Asp Glu Ser Val Ser Leu Leu Glu His Glu Ser Thr  
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Ser Leu Ser Arg Gly Pro Arg Pro Thr Glu Asp Gln Ile Ser Gln Leu  
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Pro Lys Asn Val Phe Phe Leu Leu Asp Asn Ser Ile Asp Met Ser Ile  
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Glu Thr Gly Glu Glu Asn Arg His Phe Leu Ser Glu Phe Phe Lys Leu	
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Leu Lys Lys Tyr Glu Gly Ile Asn Val Ser Leu Ile Arg Tyr Asn Ser	
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Lys Leu Ser Asp Asn Ile Pro Thr Lys Met Pro Phe Asp Ile Gly Val	
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Val Pro Thr Gly Ile Gly Ala Ala Leu Lys Gln Ile Lys Thr Leu Tyr	
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Pro Asp His Glu Lys Phe Leu Val Gly Asn Thr Ile Thr Glu Leu Asp	
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Tyr Ser Lys Ala Leu Gly Lys Asp Ile Val Val Ile Val Phe Thr Thr	
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Gly His Val Ile Asp Pro Tyr Leu Ala Tyr Asp Glu Ala Phe Asp Ala	
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Lys Asn Tyr Trp Thr Gln Leu Leu Gly Cys His Tyr Asn Thr Cys Leu	
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Ser Tyr Ile Arg Ala Lys Ile Thr Arg Pro Ser Leu Tyr Leu Asp Val	
240 245 250	
ttg gtg aac agg att gtg tct aaa cgc gcg aaa gat gcc gtt tgt ttg	1358
Leu Val Asn Arg Ile Val Ser Lys Arg Ala Lys Asp Ala Val Cys Leu	
255 260 265	
gaa gtg tgg acg gat tat aaa cct aac act gaa aaa tgc gat gtg agg	1406
Glu Val Trp Thr Asp Tyr Lys Pro Asn Thr Glu Lys Ser Asp Val Arg	
270 275 280 285	
att atg act tct acg ttg aaa tta tac aaa acc ctt ctt act gga agc	1454
Ile Met Thr Ser Thr Leu Lys Leu Tyr Lys Thr Leu Leu Thr Gly Ser	
290 295 300	
ttt gcg gag ara aac atc aaa ggt ctc aca tgt gat gag cag cta aag	1502
Phe Ala Glu Xaa Asn Ile Lys Gly Leu Thr Cys Asp Glu Gln Leu Lys	
305 310 315	
gat atg cag aaa aga caa ata ttt tgc tac tca aat aag tgt gct ccc	1550

Asp	Met	Gln	Lys	Arg	Gln	Ile	Phe	Cys	Tyr	Ser	Asn	Lys	Cys	Ala	Pro	
		320					325					330				
acg	atc	tat	tca	aga	tct	tat	gtt	gac	tta	gct	att	caa	cgt	ctt	aat	1598
Thr	Ile	Tyr	Ser	Arg	Ser	Tyr	Val	Asp	Leu	Ala	Ile	Gln	Arg	Leu	Asn	
		335				340					345					
gca	aaa	gat	ttt	aaa	gag	gta	cta	gat	gag	tca	tct	tac	aga	tca	cgc	1646
Ala	Lys	Asp	Phe	Lys	Glu	Val	Leu	Asp	Glu	Ser	Ser	Tyr	Arg	Ser	Arg	
					355					360					365	
agt	ttg	caa	tca	gtg	gag	aaa	cat	aat	gag	caa	caa	aca	ggg	tct	caa	1694
Ser	Leu	Gln	Ser	Val	Glu	Lys	His	Asn	Glu	Gln	Gln	Thr	Gly	Ser	Gln	
				370					375					380		
gaa	acg	ctt	tct	gga	agc	gcc	cgt	gta	gaa	aca	agc	tta	gaa	agc	tca	1742
Glu	Thr	Leu	Ser	Gly	Ser	Ala	Arg	Val	Glu	Thr	Ser	Leu	Glu	Ser	Ser	
			385					390					395			
gta	cct	tca	tcc	tat	gtg	gca	gaa	ttg	gga	gaa	agt	gat	aca	gaa	aca	1790
Val	Pro	Ser	Ser	Tyr	Val	Ala	Glu	Leu	Gly	Glu	Ser	Asp	Thr	Glu	Thr	
		400				405						410				
tac	aaa	cag	ttg	gag	tac	ata	gat	aaa	aat	ggc	gtc	act	gtc	ttc	aac	1838
Tyr	Lys	Gln	Leu	Glu	Tyr	Ile	Asp	Lys	Asn	Gly	Val	Thr	Val	Phe	Asn	
	415					420					425					
gat	gag	ccc	act	gtt	gtt	gtc	gat	act	ccc	gag	tac	gta	caa	aag	gtg	1886
Asp	Glu	Pro	Thr	Val	Val	Val	Asp	Thr	Pro	Glu	Tyr	Val	Gln	Lys	Val	
					435					440					445	
cat	gaa	aga	gaa	atg	cag	ttt	gat	gaa	gaa	tcc	acc	cat	ctt	ccc	aac	1934
His	Glu	Arg	Glu	Met	Gln	Phe	Asp	Glu	Glu	Ser	Thr	His	Leu	Pro	Asn	
				450					455					460		
tct	ggg	aac	cac	cat	cca	cct	cat	cac	cga	aag	ggg	gcc	aac	gga	tcc	1982
Ser	Gly	Asn	His	His	Pro	Pro	His	His	Arg	Lys	Gly	Ala	Asn	Gly	Ser	
			465					470					475			
ggg	aaa	aag	acc	acg	atc	gtc	gtt	ggg	att	ata	tgc	ctt	gta	gta	ata	2030
Gly	Lys	Lys	Thr	Thr	Ile	Val	Val	Gly	Ile	Ile	Cys	Leu	Val	Val	Ile	
		480				485						490				
tgc	gcc	gtc	ata	gcc	ggc	gcc	tac	cta	tcc	ctt	tca	cag	caa	gag	tct	2078
Cys	Ala	Val	Ile	Ala	Gly	Ala	Tyr	Leu	Ser	Leu	Ser	Gln	Gln	Glu	Ser	
	495					500					505					
gtg	gaa	ctc	acc	tct	gaa	gag	ggg	gac	ttc	ttg	aac	gac	act	acg	ggg	2126
Val	Glu	Leu	Thr	Ser	Glu	Glu	Gly	Asp	Phe	Leu	Asn	Asp	Thr	Thr	Gly	
	510				515					520					525	
ggg	caa	cct	gag	gta	ctc	gaa	aca	caa	cag	gtt	gtg	gat	gca	gag	aac	2174
Gly	Gln	Pro	Glu	Val	Leu	Glu	Thr	Gln	Gln	Val	Val	Asp	Ala	Glu	Asn	
				530					535					540		
aaa	aca	tgg	ttg	taa	gac	acg	aaa	aac	ggg	ttg	gtc	ac	gca	aa	tgc	2229
Lys	Thr	Trp	Leu													
			545													
gtt	ttaa	atta	agtc	act	agt	t	taaaaa	aaaaa								2259



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 <222> (305)..(305)  
 <223> The 'Xaa' at location 305 stands for Arg, or Lys.

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Met Val Lys Phe His Thr Leu Ser Val Ala Ala Ile Leu Ala Ile Ala  
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Ser Ser Asn Thr Ile Phe Ala Thr Phe Arg Ser Asn Gly Lys Thr Phe  
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Gly Asp Glu Ser Val Ser Leu Leu Glu His Glu Ser Thr Ser Leu Ser  
 35 40 45

Arg Gly Pro Arg Pro Thr Glu Asp Gln Ile Ser Gln Leu Pro Lys Asn  
 50 55 60

Val Phe Phe Leu Leu Asp Asn Ser Ile Asp Met Ser Ile Glu Thr Gly  
 65 70 75 80

Glu Glu Asn Arg His Phe Leu Ser Glu Phe Phe Lys Leu Leu Lys Lys  
 85 90 95

Tyr Glu Gly Ile Asn Val Ser Leu Ile Arg Tyr Asn Ser Glu Glu Pro  
 100 105 110

Leu Gly Ser Thr Lys Ala Leu Thr Asn Gly Glu Leu Lys Lys Leu Ser  
 115 120 125

Asp Asn Ile Pro Thr Lys Met Pro Phe Asp Ile Gly Val Val Pro Thr  
 130 135 140

Gly Ile Gly Ala Ala Leu Lys Gln Ile Lys Thr Leu Tyr Pro Asp His  
 145 150 155 160

Glu Lys Phe Leu Val Gly Asn Thr Ile Thr Glu Leu Asp Tyr Ser Lys  
 165 170 175

Ala Leu Gly Lys Asp Ile Val Val Ile Val Phe Thr Thr Gly His Val  
 180 185 190

Ile Asp Pro Tyr Leu Ala Tyr Asp Glu Ala Phe Asp Ala Arg Arg Asn  
 195 200 205

Gly Val Arg Phe Tyr Val Ile Asn Arg Gly Gly Lys Ala Lys Asn Tyr  
 210 215 220

Trp Thr Gln Leu Leu Gly Cys His Tyr Asn Thr Cys Leu Ser Tyr Ile  
 225 230 235 240

Arg Ala Lys Ile Thr Arg Pro Ser Leu Tyr Leu Asp Val Leu Val Asn  
 245 250 255

Arg Ile Val Ser Lys Arg Ala Lys Asp Ala Val Cys Leu Glu Val Trp  
 260 265 270

Thr Asp Tyr Lys Pro Asn Thr Glu Lys Ser Asp Val Arg Ile Met Thr  
 275 280 285

Ser Thr Leu Lys Leu Tyr Lys Thr Leu Leu Thr Gly Ser Phe Ala Glu  
 290 295 300

Xaa Asn Ile Lys Gly Leu Thr Cys Asp Glu Gln Leu Lys Asp Met Gln  
 305 310 315 320

Lys Arg Gln Ile Phe Cys Tyr Ser Asn Lys Cys Ala Pro Thr Ile Tyr  
 325 330 335

Ser Arg Ser Tyr Val Asp Leu Ala Ile Gln Arg Leu Asn Ala Lys Asp  
 340 345 350

Phe Lys Glu Val Leu Asp Glu Ser Ser Tyr Arg Ser Arg Ser Leu Gln  
 355 360 365

Ser Val Glu Lys His Asn Glu Gln Gln Thr Gly Ser Gln Glu Thr Leu  
 370 375 380

Ser Gly Ser Ala Arg Val Glu Thr Ser Leu Glu Ser Ser Val Pro Ser  
 385 390 395 400

Ser Tyr Val Ala Glu Leu Gly Glu Ser Asp Thr Glu Thr Tyr Lys Gln  
 405 410 415

Leu Glu Tyr Ile Asp Lys Asn Gly Val Thr Val Phe Asn Asp Glu Pro  
 420 425 430

Thr Val Val Val Asp Thr Pro Glu Tyr Val Gln Lys Val His Glu Arg

435 440 445

Glu Met Gln Phe Asp Glu Glu Ser Thr His Leu Pro Asn Ser Gly Asn  
450 455 460

His His Pro Pro His His Arg Lys Gly Ala Asn Gly Ser Gly Lys Lys  
465 470 475 480

Thr Thr Ile Val Val Gly Ile Ile Cys Leu Val Val Ile Cys Ala Val  
485 490 495

Ile Ala Gly Ala Tyr Leu Ser Leu Ser Gln Gln Glu Ser Val Glu Leu  
500 505 510

Thr Ser Glu Glu Gly Asp Phe Leu Asn Asp Thr Thr Gly Gly Gln Pro  
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Glu Val Leu Glu Thr Gln Gln Val Val Asp Ala Glu Asn Lys Thr Trp  
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Leu  
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